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Dispersion Model for Elevated Dense Gas Jet Chemical Releases Volume 1. Documentation

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A Dispersion Model For Elevated Dense Gas Jet Chemical Releases

Volume I.

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16. ABSTRACT

This document is the first of two volumes describing the development and use of a computer program designed to model the dispersion of heavier-than-air gases which are emitted into the atmosphere with significant velocity through elevated ports. The program incorporates the sequential execution of two models. The first one (Ooms) calculates the trajectory and dispersion of the gas plume as it falls to the ground. The second (DEGADIS) calculates the downwind dispersion after the plume touches ground.

This first volume discusses the development of both models and establishes the mathematical framework for the calculations. In addition, the trajectory portion of the model is evaluated in reference to wind tunnel data.

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This report has been reviewed by the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, and approved for publication as received from Dr. Jerry Havens. Approval does not signify that the contents necessarily reflect the views and policies of the U. S. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. Copies of this report are available from the National Technical Information Service (NTIS). .

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The elevated dense gas jet model incorporates methodology published by Ooms and his colleagues at the Technological University Delft, The Netherlands, along with the DEGADIS dense gas dispersion model developed at the University of Arkansas. Tom Spicer, my coauthor of DEGADIS, contributed to the development and was responsible for the modifications to DEGADIS required for interfacing with Ooms' model.

Jerry Havens

PREFACE

This version of the elevated dense gas dispersion model, Ocms/DEGADIS, has been developed by Dr. Jerry Havens and Dr. Tom Spicer of the University of Arkansas with the support of funding from the United States Environmental Protection Agency (EPA). It represents intermediate development of a dense gas modeling package which is undergoing further refinement through additional EPA support. While this model has not been extensively tested against field data, and is subject to specific limitations and uncertainties, the EPA is making it publicly available through the National Technical Information Service (NTIS) as an interim research tool pending further model evaluation and development.

The Ooms/DEGADIS model has been written in FORTRAN with specific intent for compilation and execution on a Digital Equipment Corporation VAX computer. Implementation of this model on any other computer system may be attempted at the risk of the user. Considerations for such implementation, however, are discussed in Appendix B of Volume II.

To facilitate dissemination of the model, it is being provided on two PC-compatible diskettes. The model should be uploaded via modem from a PC terminal to a host VAX computer, and several files must then be renamed prior to compilation and execution. Specific information on this process is contained in the file AAREADME.TXT. Print this file and the compilation batch file, BUILD.COM, prior to attempting compilation.

It is the concern of the EPA that this model be applied only within the framework of its intended use. To this end the user is referred to the specific recommendations in Volume I, Section VII for model application. These recommendations take advantage of the fact that, in this version of the Ooms/DEGADIS model, the portion of the model adapted from Ooms and his colleagues can be executed as a standalone model, as can the DEGADIS portion. To begin any particular simulation, it is recommended that the Ooms portion of the model be executed by itself.

This can be accomplished by setting the input variable <TEND> equal to 1. If the output from this simulation predicts that the plume will touch down less than 1 kilometer from the source, the complete Ooms/DEGADIS model may be appropriately applied (set <TEND> equal to zero or greater). If the plume is not predicted to touch down within 1 kilometer, this model should not be used.